

## **1.0 INTRODUCTION**

### **1.1 *Purpose***

The primary purpose of this Vernal Pool Management Plan (Plan) is to provide management strategies, directives, and recommendations for all lands containing vernal pools in the City of San Diego in order to preserve and restore their physical function and biotic components, including the recovery of associated threatened and endangered species. In the development of this Plan, the City analyzed current, standardized data (City, 2003) and historical surveys (Beauchamp, 1979; Recon, 1979; Bauder, 1986) to inform the understanding of the management needs of San Diego's vernal pools and challenges. The results of these analyses are presented at both general (City-wide) and local (site-specific) scales. The regulatory requirement(s) to comply with this plan varies according to the status (e.g., ownership) of a given site and is noted in each site-specific discussion. Existing requirements and recommendations, such as United States Fish and Wildlife Service Biological Opinions, are also included and referenced in the Plan.

This plan is intended to guide vernal pool management on public and private, preserved and developable lands within the City of San Diego. The history, issues, requirements, and goals for each site provide direction for public and private planners, environmental professionals, and others interested in land development and management.

## **2.0 EXISTING CONDITIONS**

### **2.1 *Natural History of Vernal Pools***

Functional vernal pool ecosystems form under specific physical conditions. Vernal pools form when small, shallow depressions collect precipitation to create a seasonally perched water table. These basins are oval to circular in shape and one to 700 square meters in size (Zedler, 1987). Although such basins may occur on level surfaces, they are often associated with hillocks known as Mima mounds. In San Diego County, these features range from three to 20 meters in diameter and 0.4 to 1.2 meters in height and function as water catchments with vernal pools forming in inter-mound swales (Zedler, et al., 1979). Vernal pools in the City of San Diego are associated with Huerhuero, Stockpen, Redding and Olivenhain soil series, and the basins are sealed by subsurface layers of impervious hardpan, or clay that expands to seal the basin when saturated (Greenwood and Abbot, 1980).

These ecosystems are defined by seasonal hydrologic extremes: desiccated pool basins during the dry months followed by variable lengths of saturation and inundation during the rainy season. In southern California, the inter-annual variation in precipitation augments the inconsistent moisture conditions. This drastic change between vegetated wetland and dry basin defines a vernal pool and separates them from other wetland ecosystems.

Although seasonal wetlands are found worldwide, vernal pools sharing physical and biological parameters occur within the Mediterranean climate zone of the western United States, from southern Oregon, to northern Baja California, Mexico. In southern California, remnants of historic vernal pool complexes occur on coastal mesas in the counties of Santa Barbara, Los Angeles, Orange and San Diego, as well as inland in the San Diego foothills and Riverside basalt terraces. Within the City of San Diego, groups of vernal pools called "series" are found in the following areas: Del Mar Mesa, Mira

Mesa, Carmel Mountain, Kearny Mesa, Mission Trails Regional Park, Otay Mesa and nearby Otay Lakes, and Marron Valley.

Although generalist wetland plants often occur in vernal pools, these ecosystems provide habitat for a large number of endemic species. The special adaptations of vernal pool flora, noted by Purer (1939), have been explored in subsequent research (Holland and Jain, 1977; Zedler, 1987; USFWS, 1998). Zedler (1986) found 47 species in 20 families that are restricted to vernal pool habitat. Several genera are endemic to vernal pool habitats in California (e.g., *Pogogyne*, *Psilocarphus*, *Downingia*) while some species, such as *P. abramsii*, are restricted to San Diego County. Such vernal pool specialists exhibit many adaptations to their highly variable habitat. These species generally have a short growing period that falls within the limited months of basin inundation. In addition, many have flexible morphologies (i.e. *Callitriche marginata*) or photosynthetic paths (i.e. *Isoetes howellii*) to allow optimal responses to a variety of inundation patterns.

Animals that utilize vernal pools range from tiny insect larvae to amphibians, birds, and mammals. Pools may be the sole habitat or reproductive environment of invertebrates, such as terrestrial insects and freshwater invertebrates. Species diversity for invertebrates in vernal pools has been significantly correlated to factors directly related to human disturbance, such as pool size, basin depth, and length of pool inundation (Zedler, et al., 1979; King, et al., 1996). Five groups of zooplankton have received extensive scientific attention, especially the fairy shrimp, with two federally endangered species in two genus (Zedler, et al., 1979; Eng, et al., 1990; Fugate, 1993; USFWS, 1998).

Native amphibians (e.g., *Hyla regilla*, *Bufo boreas*, and *Spea hammondi*) and reptiles (e.g. *Thamnophus hammondi*) specifically utilize vernal pool habitat. The life histories of the amphibians are especially adapted to ephemeral ponds. These species have a comparatively short development cycle and a dormant summer phase so that maturation and reproduction may be completed during the short inundation time (USFWS, 1998). Reptiles are known to use vernal pools as feeding areas (USFWS, 1998; pers. obs., 2003) and may utilize the micro-climate for thermoregulation. Larger animals use the nutrient and water resources provided by vernal pools. These ecosystems are especially important to migrating birds and local animals in areas characterized by limited resources (Silveria, 1996; USFWS, 1998).

## 2.2 Sensitive Species

Sensitive biological resources found in San Diego vernal pools include two federally endangered invertebrates, five federally endangered plants, and a rare but little-known plant that is not protected. All of the federally listed species have been included in the accepted federal document, *Recovery Plan for Vernal Pools of Southern California* (USFWS, 1998). Management recommendations for this plan are based on surveys and abundance measurements for these species collected during the 2002-2003 rainy season; plant data are from the Vernal Pool Inventory (City, 2004) and fairy shrimp data are from the Inventory and a USFWS GIS database.

**San Diego button-celery (*Eryngium aristulatum* var. *parishii*)**

San Diego button-celery was listed by the U.S. Fish and Wildlife Service as an endangered species on August 3, 1993, fourteen years after it was listed as endangered by the State of California. It is a CNPS List 1B species, and is a narrow endemic species under the City of San Diego Land Development Code Biology Guidelines (2001). This species was covered under the MSCP prior to the Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers ruling (2001). A perennial herb, San Diego button celery has a prickly appearance due to stems and toothed leaves with spinose lobes. It may reach up to 41 cm in either a spreading or erect morphology. This gray-green member of the carrot family (Apiaceae) is found from Riverside County to Baja California, Mexico. In San Diego, *E. aristulatum* is found in 804 basins, 686 of which are conserved. A slight majority of the basins containing these populations are natural (416), with 385 intensively restored basins and two enhanced. This species is found at 26 sites in nine series, over approximately 442 square miles within San Diego.

**Little mousetail (*Myosurus minimus* ssp. *apus*)**

Little mousetail is an annual herb in the Ranunculaceae, or buttercup, family. Although not protected by federal, state, or MSCP listing, it has been recognized as a CNPS List 3 species. This diminutive plant has narrow leaves that surround the single flower in a basal rosette. It blooms from March to June following the inundation of its alkaline vernal pool habitat, and is found from Oregon to Baja California, Mexico. In the City of San Diego, *M. minimus* is found in 17 natural and 34 intensively restored vernal pools (49 are conserved), all in the J series, over an area of approximately six square miles.

**Spreading navarretia (*Navarretia fossalis*)**

Spreading navarretia was listed as a federally endangered species on October 13, 1998. It is also a CNPS List 1B species, and is considered to be a narrow endemic species under the City of San Diego Land Development Code Biology Guidelines (2001). This species was covered by the MSCP prior to the Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers ruling (2001). An annual herb with a low, spreading morphology, this plant is a member of the phlox family (Polemoniaceae). White flowers appear among the soft, spine-tipped leaves near the end of the stems. Spreading navarretia was described only 35 years ago, and was historically found from San Luis Obispo County to Baja California, Mexico. Today, fewer than 30 populations exist in the United States, including those on Otay Mesa in the City of San Diego (USFWS, 1998). In San Diego, *N. fossalis* is found in six natural basins and 93 intensively restored basins, 95 of which are conserved. Individuals or populations are found at 12 sites in four series over a range of approximately 231 square miles.

**California Orcutt grass (*Orcuttia californica*)**

California Orcutt grass was listed as endangered by the State of California in 1979 and by the U.S. Fish and Wildlife Service on August 3, 1993. It is a CNPS List 1B species, and is a narrow endemic species under the City of San Diego Land Development Code Biology Guidelines (2001). This species was covered by the MSCP prior to the Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers decision (2001). This species is a small annual grass that may reach 10 cm in height. It is a member of the Poaceae, or grass, family. California Orcutt grass is found in Los Angeles, Riverside, and San Diego Counties, and in Baja California, Mexico (USFWS, 1998). In San Diego, this species is found in 58 vernal pools, 57 of which are conserved; one of these is a naturally occurring basin. Populations are found at five sites in the J series over a range of slightly less than two square miles.

**San Diego mesa mint (*Pogogyne abramsii*)**

San Diego mesa mint was listed as endangered by the federal government on September 28, 1978, and was listed the following year by the State of California. This plant is a CNPS List 1B species, and is a narrow endemic species under the City of San Diego Land Development Code Biology Guidelines (2001). It was covered under the MSCP prior to the Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers ruling (2001). San Diego mesa mint is an annual herb that blooms following the spring rains, generally from May to July. It is a member of the mint family, Lamiaceae, and gives off a strong, sweet odor. The stems are often branched with green leaves and purple flowers and may reach up to 30 cm in length. San Diego mesa mint is endemic to vernal pool ecosystems in San Diego County (USFWS, 1998). In the City of San Diego, this species is found in 341 natural basins and 31 enhanced/restored basins, 210 of which are conserved. Populations occur at 16 sites in seven series over a range of nearly 45 square miles.

**Otay mesa mint (*Pogogyne nudiscula*)**

Otay mesa mint was listed as endangered by the State of California in 1987 and by the U.S. Fish and Wildlife Service on August 3, 1993. It is a CNPS List 1B species, and is a narrow endemic species under the City of San Diego Land Development Code Biology Guidelines (2001). This species was covered under the MSCP prior to the Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers ruling (2001). The scent of this mint family (Lamiaceae) member may be described as a strong, minty turpentine. This species is similar to San Diego mesa mint in size, life history, and morphology. Otay mesa mint is found only in Otay mesa vernal pools, although there are historic reports of populations in Tijuana (USFWS, 1998). This species was found at six natural basins and 370 intensively restored basins in San Diego, 374 of which are conserved. Populations occur at nine sites in the J series over a range of approximately 10 square miles.

**San Diego fairy shrimp (*Branchinecta sandiegonensis*)**

San Diego fairy shrimp were listed as endangered by the USFWS on February 3, 1997. The species was covered by the MSCP prior to the Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers ruling (2001). This vernal pool habitat specialist is a crustacean in the family Branchinectidae, order Anostraca. Immature fairy shrimp hatch from cysts following sufficient inundation of the vernal pool basins. After a short maturation period, the adults mate and lay eggs that lie dormant until another rainy season. The development of San Diego fairy shrimp is influenced by water temperature, chemistry, and other environmental cues. The adults, which may reach up to 16 mm in length, swim on their backs propelled by 11 pairs of legs. San Diego fairy shrimp were described by Fugate in 1993 and have been found in Santa Barbara, Los Angeles, Riverside, and San Diego Counties.

**Riverside fairy shrimp (*Streptocephalus woottonii*)**

Riverside fairy shrimp were listed as endangered by the USFWS on August 3, 1993, and were covered by the MSCP prior to the Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers ruling (2001). This small freshwater crustacean is a member of the family Streptocephalidae, order Anostraca. Riverside fairy shrimp have a life history similar to San Diego fairy shrimp, although Riverside fairy shrimp prefer deeper vernal pools. They are also larger than San Diego fairy shrimp, growing up to 25 mm in length. Riverside fairy shrimp were recognized as a species in 1985 and have been found in Orange, Riverside, and San Diego Counties, and in Baja California, Mexico.

**3.0 REGULATORY FRAMEWORK****3.1 Management History in San Diego**

Various vernal pool protection efforts have been implemented by the City of San Diego, California Department of Fish and Game, U.S. Fish and Wildlife Service and other interested parties in the San Diego region. Protection mechanisms have increased in effectiveness and efficiency over time due to improved knowledge of these resources. This management plan, while building on previous efforts, attempts to further refine and improve vernal pool preservation strategies in the City of San Diego.

**Vernal Pool Preservation Program (1980)**

The Vernal Pool Preservation Program (VPPP) was adopted by the San Diego City Council on June 17, 1980, in an effort to balance conservation of the federally endangered San Diego mesa mint (*P. abramsii*) with public and private development concerns. The program included a framework for protection of representative complexes by prioritizing vernal pool groups according to factors such as disturbance, site defensibility, and the presence of sensitive species. The ranking system was used by a collaborative decision-making group to determine regulatory procedures for specific vernal pools. This committee selected certain areas with high quality vernal pools to be subject to individual Section 404 permits administered by the U.S. Army Corps of Engineers (Corps) under the Clean Water Act (CWA). Other areas, especially those with low priority vernal pools, were included in the Section 404 nationwide permit to decrease the difficulty of development. Prior to project approval, all areas were subject to an

environmental review process under the California Environmental Quality Act (CEQA), which included mitigation of vernal pool impacts through preservation of resources on-site or contributions to the Vernal Pool Fund. This account was designated for the purchase, research, and maintenance of vernal pools and their associated habitat in the City of San Diego.

#### **Vernal Pool Management Plan (1996)**

In 1996, the City of San Diego developed a management plan in conjunction with the Multiple Species Conservation Program Subarea Plan (City of San Diego, 1997) for City-owned vernal pool sites. The Vernal Pool Management Plan (City of San Diego, 1996) created the Coordinated Management Program to improve interdepartmental dialogue and response to regional resource management issues. Individual sites were also discussed in detail, including existing conditions and biological reports, threats, current management activities, and specific recommendations. Implementation of the recommendations set forth in the Vernal Pool Management Plan were not required, with the exception of two mitigation parcels; however, the document has provided important information and guidance for land managers and other concerned with the conservation of San Diego vernal pools.

#### **Vernal Pools Stewardship Project of the San Diego National Wildlife Refuge**

In April 1997, the USFWS approved the Vernal Pools Unit of the San Diego National Wildlife Refuge (NWR) as part of the Vernal Pools Stewardship Project. The project was designed to complement the MHPA and provide for the recovery of Endangered Species Act (ESA) listed species by sanctioning NWR acquisition and management of vernal pool habitat. The refuge planning boundary contains approximately 8,225 acres across the County and City of San Diego, and includes vernal pools sites at Del Mar Mesa, Lopez Ridge, and Montgomery Field, Otay Lakes, and Otay Mesa.

#### **Recovery Plan for Vernal Pools of Southern California (USFWS, 1998)**

The U.S. Fish and Wildlife Service published the Recovery Plan for Vernal Pools of Southern California (Recovery Plan), which was accepted on September 3, 1998. This planning document deals specifically with recovery criteria for the federally listed species that occur in San Diego vernal pools. To achieve the objective of stabilizing and protecting these sensitive populations, the USFWS recommended the following tasks:

- 1) Establish vernal pool preserves designed to optimize the recovery potential of the listed species.
- 2) Recreation of the historic structure and function of vernal pool ecosystems for improved genetic diversity and population stability.
- 3) Rehabilitation efforts to enhance vernal pool habitats for their associated species.
- 4) Specific and adaptive management for vernal pool preserves.
- 5) Monitoring of vernal pools, especially listed species, on preserve lands.

This Vernal Pool Management Plan, and the associated Vernal Pool Inventory (City of San Diego, 2004), are being completed in accordance with these recommendations and will, in part, fulfill certain recovery tasks.

### **3.2 *Interested Parties and Applicable Regulations***

The regulation and management of vernal pools is of interest to landowners, environmentalists, developers, governmental agencies, and concerned citizens. This section discusses the government entities with regulatory interest in vernal pool management as well as the laws that direct their involvement. A brief discussion of interested parties participating in the stakeholder group is also included.

#### **U.S. Fish and Wildlife Service**

The U.S. Fish and Wildlife Service is the federal agency responsible for administering the Endangered Species Act. The ESA prohibits “take” (to kill, harm, or harass) of endangered or threatened animals and ensures that actions taken or permitted by federal agencies do not jeopardize the continued existence of endangered or threatened species. An “endangered species” is defined by the ESA as one that is in danger of extinction throughout all or a significant portion of its range while a “threatened species” is likely to become endangered within the foreseeable future throughout all of a significant portion of its range. Vernal pools in the City support one threatened plant, four endangered plants, and two endangered animals.

#### **U.S. Army Corps of Engineers**

The U.S. Army Corps of Engineers has authority over fill discharged into “waters of the United States” under Section 404 of the Clean Water Act. The Corps regulates these activities through a permitting process, and historically included vernal pools, road ruts and other unvegetated pools in their regulatory oversight. However, Supreme Court rulings in 2001 and 2006 questioned the Corps’ regulation of isolated water bodies such as vernal pools (see *Solid Waste Agency of Northern Cook County v. U. S. Army Corps of Engineers* [531 U.S. 159] [SWANCC] and *Rapanos v. United States*, 126 S. Ct 2208, U.S.). Subsequent to these rulings, the Corps has made determinations regarding regulation of such wetland areas on a case-by-case basis, and the Corps’ continued regulation of vernal pools is uncertain.

#### **California Department of Fish and Game**

The California Department of Fish and Game (CDFG) administers the California Endangered Species Act (CESA) which is independent of, though similar to, the federal ESA. When species appear on both state and federal lists, the USFWS is the lead agency with cooperation from CDFG. CDFG is responsible for species listed only by the State of California under the CESA and for the general welfare of fish and wildlife as a public trust. Four vernal pool plant species, also listed by the federal government, are considered to be endangered by the State of California.

## **Regional Water Quality Control Board**

Under federal Clean Water Act (CWA) section 401 every applicant for a federal permit or license for activities which may result in a discharge to a water body must obtain State Water Quality Certification (Certification) that the proposed activity will comply with state water quality standards. Porter-Cologne Act establishes water quality oversight and Regional Water Quality Control Boards to oversee these certifications, as well as other responsibilities.

## **City of San Diego**

The City of San Diego is the agency responsible for the application of local environmental regulations. Several City departments are involved in vernal pool conservation and management through project review and permitting, ownership, open space management, and the MSCP.

### Development Services Department

The Development Services Department (DSD) reviews and permits projects in accordance with National Environmental Policy Act (NEPA), California Environmental Quality Act (CEQA), and City of San Diego Land Development Code regulations, as necessary. NEPA applies to the major actions of all federal agencies, which are subject to review for environmental impacts during the planning process. Failure to follow the procedural mandates of NEPA may result in failure to obtain federal permits and/or funding, or in third-party litigation. CEQA requires environmental impact assessment and mitigation for non-exempt projects occurring within the State of California. As unique ecosystems associated with endangered and threatened species, vernal pools are considered rare biological resources in NEPA and CEQA review.

The Land Development Code regulates development in the City of San Diego, including the Environmentally Sensitive Lands (ESL) Ordinance that determines the appropriate development footprint within or adjacent to sensitive biological resources. This ordinance outlines the City policy for no net loss of wetland functions and values, including avoidance of impacts to vernal pools and appropriate buffer systems. When impacts are unavoidable, deviation findings that include specific mitigation requirements must be made.

In addition, the Land Development Code Biology Guidelines (2001) lists *Eryngium aristulatum* var. *parishii*, *Navarretia fossalis*, *Orcuttia californica*, *Pogogyne abramsii*, and *P. nudiuscula* as narrow endemic species. Narrow endemics are included in the definition of Environmentally Sensitive Lands, which requires a discretionary review of the project permit including biological surveys and species specific mitigation requirements.

### Real Estate Assets Department and Other Land Owners

City departments are responsible for the sensitive resources that occur on land under their management. For example, the Parks and Recreation Open Space Division is responsible for management of open space areas owned by the City. Many mitigation sites and other areas under conservation easements are also managed by this department. Parks and Recreation has installed fencing and signage to protect vernal pools on lands such as Mission Trails Regional Park and the Carroll Canyon Vernal Pool Preserve.

Vernal pools are also found on land managed by the Water Department and the Real Estate Assets Airports Division.

### Multiple Species Conservation Program

The Multiple Species Conservation Program (MSCP) is a habitat conservation plan for regional endangered species conservation through habitat conservation and management. It was created to meet the requirements of both the ESA section 10 (a) and the state of California NCCP act. The MSCP allows local governments to issue incidental take permits for federal and state listed species in exchange for the preservation of large, contiguous open space areas. This preserve system is called the Multi-Habitat Planning Area (MHPA), which is a planning zone for core biological resources and corridors targeted for conservation; the type and extent of development allowed within the MHPA is limited by local regulations. Although the MSCP does not confer take authority for endangered and threatened wetland species (including vernal pool species), the MSCP refers to the City of San Diego Vernal Pool Management Plan (1996) for management recommendations and site-specific mitigation requirements. Upon adoption by the City Council, this Vernal Pool Management Plan will replace the existing document.

### **Non-Governmental Organizations**

In addition to government agencies and local consulting firms, the following NGOs and academic institutions participated in the Plan stakeholder group. This group was instrumental in shaping the scope of this document.

- Building Industry Association
- California Native Plant Society
- Center for Biological Diversity
- Conservation Biology Institute
- San Diego Baykeeper
- San Diego State University
- University of San Diego
- Vernal Pool Society

## **4.0 MANAGEMENT ISSUES**

### **4.1 *Overview***

A variety of management issues have been identified regarding vernal pools in the San Diego region. These vernal pools have been the subject of scientific study since 1939, and multiple, large-scale surveys have been conducted since 1979. Because data are available at this temporal scale, it is important to 1) recognize the changes that have occurred in the regulations, landscape, and land use over time, and 2) study the correlations of historic and current management strategies to significant trends in the number, distribution, and health of vernal pools in San Diego. This section discusses issues noted in historic reports and their current status, as well as more recent issues reported in the City's Vernal Pool Inventory (2003) in order to develop an accurate perspective of contemporary resource management.

## **4.2 Issues**

Successful vernal pool management and preservation must address numerous issues. In 1986, Dr. Ellen Bauder conducted an in-depth study of factors threatening San Diego vernal pools. This information was combined with site visits to create management recommendations for City-owned vernal pool sites in 1996 (City of San Diego, 1996). The current status of these issues and adaptive policy procedures for their management, if any, are discussed here.

### **Development**

The elimination of vernal pool habitat by urban development projects has been the primary threat to these ecosystems. The mesas where vernal pools occur are easily developed due to dry, flat topography, and extensive private and public construction projects have been sited in these areas. Although development continues to jeopardize vernal pool ecosystems, current planning procedures emphasize sensitive resource avoidance and mitigation, if necessary. Many of the remaining vernal pool complexes have been protected through public acquisition and conservation easements to decrease the threat of future development to vernal pools.

### **On-going Activities**

Many activities occur on lands where vernal pools are found. In certain cases, on-going use of these lands may incidentally impact sensitive resources on-site. For instance, vernal pools occur on lands owned and/or managed the City of San Diego Airports Division, Parks and Recreation Department, and by local utility companies. Routine maintenance of facilities may cause damage to vernal pools, especially when work crews are unaware of their location and characteristics. The risk of damage to vernal pools may be decreased through signage, fencing, and employee education.

In the past, vernal pools were often destroyed by draining, tilling, and planting in conjunction with agricultural production. This threat has lessened as the amount of land in agricultural production in San Diego has decreased. Similarly, livestock grazing once posed a threat to vernal pools throughout San Diego. By 1986, Bauder noted that cattle grazing had been replaced by development in the northern areas. No legal livestock grazing currently occurs in areas known to have vernal pools; however, illegal grazing has been observed at two sites.

Several vernal pool sites occur on dedicated open space or other areas actively used for outdoor recreation. Pedestrian, equestrian, and bicycle traffic poses a moderate hazard to vernal pools in some areas. In most cases, signage and fencing are provided for City parks and public recreation areas. On sites that have recently been acquired for mitigation or public lands, these protective measures may not yet be installed. Vernal pools on privately owned open space are generally at the highest risk of impact from outdoor recreation.

Vernal pools along the U.S./Mexican border have been impacted by Border Patrol activities. Although it is assumed that there is some impact from foot traffic of both illegal immigrants and Border Patrol agents, the majority of damage occurs from off-road activities. In addition to directly destroying vernal pools, these roads are often used and expanded by recreational off-road vehicle users trespassing on public lands.

Similar to the Border Patrol, emergency response teams may impact vernal pools while providing vital services. Fire suppression and aviation emergencies are threats to certain vernal pools sites in San Diego. Many vernal pools occur within or adjacent to large open space areas that have burned multiple times in recent fire history. For example, the Marron Valley Fire Management Plan was prepared to direct fire-fighting activities in this area. Vernal pools are also found near both Brown Field and Montgomery Field airports where aviation emergency response is an issue. To mitigate threats from these situations, contingency plans have been created for several areas to direct emergency crews away from sensitive resources. While the threat to vernal pools remains high in some areas, it has been lowered in others through advance planning, training, and directive signage.

### **Illegal Activities/Trespass**

Off-road vehicle (ORV) use is a major impact to vernal pools in the City of San Diego. Although significant disturbance occurred historically in areas such as Del Mar Mesa, the majority of ORV use is currently near the border in Otay Mesa. Large areas of publicly-owned lands with posted “No Trespassing” signs are consistently used by ORV enthusiasts, and the availability of law enforcement officers is limited. Only large, fenced mitigation sites (e.g., Cal Terraces) appear to be protected from ORV impacts. Bauder noted the ubiquitous impacts of ORVs in 1986, and vernal pools in southern San Diego continue to be degraded by these activities.

Dumping has resulted in the degradation of vernal pools throughout San Diego. In urbanized areas, lawn and tree clippings are found within vernal pool preserves. Construction materials, furniture, and old cars are frequently observed in remote areas within and adjacent to vernal pool basins. Although fencing partially reduces this threat, many vernal pool complexes remain at risk from dumping.

Litter is a significant negative impact to vernal pool ecosystems, and has been observed at nearly all vernal pool complexes, including those in remote areas. Litter is often washed into basins by storm events where it may smother or crowd plant and animal species dependent on vernal pools. This is a threat to vernal pool areas where regular trash collection programs are not in place.

### **Habitat Fragmentation and Edge Effects**

Bauder (1986) noted the dangers of hydrologic alterations to vernal pool ecosystems in *San Diego vernal pools: Recent and projected losses, their condition, and threats to their existence, 1979-1990*. Run-off from agricultural and urban areas has altered the length of inundation at certain vernal pools. Agricultural uses have, to a large degree, abated in San Diego while urban areas continue to grow. Siltation was also listed as a concern in the 1986 report (Bauder, 1986). Best management practices (BMPs) for construction sites are expected to reduce the run-off and siltation from these areas. However, urban run-off is still a threat to vernal pools and must be considered in preserve planning and design.

Disturbance and fragmentation of native habitat are highly correlated with the invasion of exotic species. For example, vernal pools in areas where grazing occurred have high occurrences of non-native species. Non-native species alter the biodiversity of these ecosystems through competition with endemic vernal pool flora. Restoration and

mitigation projects incorporate exotic removal programs into their site management plans, but many vernal pool sites remain impacted by exotic species.

Bauder (1986) discusses the interruption of dispersal through habitat fragmentation. Concerns have been raised over disruption of pollination activities and mammalian/avian dispersal activities due to isolation; however, more research is needed on the specific dispersal processes of vernal pool species in order to draw definitive conclusions. San Diego fairy shrimp genetic research completed as part of the Vernal Pool Inventory (City of San Diego, 2004) suggests that a significantly higher rate of dispersal occurs in disturbed areas due to anthropogenic factors not present in remote areas.

The effects of air and water pollution and climate change on vernal pools have not received extensive study. Vernal pool species are sensitive to chemical changes (Simovich, *et al.*, 1996) and it is expected that changes due to pollution will negatively affect these ecosystems. Local regulations require sufficient watershed area to be incorporated into vernal pool preserves to limit pollution and maintain viability of the basin (City of San Diego, 1999). Pollution and global warming may continue to degrade vernal pools as well as other ecosystems; however, direct links between these factors and vernal pool ecosystem health are not well understood.

The destruction and fragmentation of vernal pools may lead to the reduction of genetic diversity (Bauder, 1986). Data from San Diego fairy shrimp genetic research conducted in conjunction with the Vernal Pool Inventory (City of San Diego, 2004) has shown high complex-level endemism with a division of two clades at the larger geographic scale. This reinforces the importance of series and even individual basins to the health of both molecular and ecosystem processes.

## **5.0 CONSERVATION ANALYSIS**

### **5.1 *Gains and Losses Over Time***

Several vernal pool surveys have been conducted in San Diego. In 1986, Ellen Bauder proposed to relocate all vernal pools mapped by the California Department of Fish and Game (Beauchamp, 1979), City of San Diego (Balko, 1979), Pardee Construction Company (Villasenor and Riggan, 1979), and the U.S. Fish and Wildlife Service (Beauchamp, 1982). The resulting report, *San Diego vernal pools: Recent and projected losses; their condition; and threats to their existence, 1979-1990*, provided an updated regional survey and assessment of existing vernal pool conservation efforts (Bauder, 1986). In preparation for this management plan, the City of San Diego conducted an inventory of vernal pools (City of San Diego, 2004) based on Bauder's report (1986). The comparison of these study results is useful to understand changes in vernal pool distribution, and these data may then be used to evaluate and improve current management strategies and site-specific recommendations.

The 1979 surveys mapped 1,480 vernal pools at 17 series within the City of San Diego. Over half of those basins were destroyed before Bauder's survey in 1986, leaving 639 vernal pools. Seventeen years later, 2,465 vernal pools were mapped with mobile geographic information systems (GIS) and remote sensing technology (City of San Diego, 2004). Although vernal pools were lost within the City between 1986 and 2003, a greater total number of basins were mapped due to improved detection and mapping

technology, location of new complexes, and intensive vernal pool restoration (e.g. grading of new basins in areas with historic vernal pool occurrences) at mitigation sites.

Between 1979 and 1986, the majority of vernal pool losses stemmed from residential and agricultural development. Gravel mining, military activities, animal grazing, and public services development also resulted in the loss of vernal pools. From 1986 to present, sites have been primarily impacted by residential and transportation development, with a decrease in the threat of agriculture, grazing, and gravel mining. These changes must be considered in the development and analysis of regional conservation strategies and mitigation requirements.

It is important to recognize that jurisdictional boundaries are not biological boundaries. Additional vernal pools, estimated to number in the thousands, are found within the jurisdiction of the County of San Diego (County), City of Santee, City of Poway, City of San Marcos, City of Chula Vista, City of Carlsbad, San Diego Gas and Electric, Sweetwater Authority, U.S. Navy and U.S. Marine Corps, as well as in private ownership. The existence and location of these basins is recognized in this Plan in an effort to maximize habitat connectivity and provide implementable conservation mechanisms.

## **5.2 Definitions**

### **Conserved or Unconserved?**

Vernal pool basins within the City of San Diego may be conserved through a variety of mechanisms. Fifty-four percent, or 1,369 vernal pools, are currently considered conserved by covenant of easement, conservation easement, or dedication in fee title to the City.

Unconserved sites are those areas, in public or private ownership, which are not covered by a covenant of easement, conservation easement, or dedicated in fee title to the City. For example, privately owned parcels with development potential are considered unconserved. In addition, public land with restricted development rights, such as Montgomery Field, are also considered unconserved because the City-owned site is protected by navigational easements rather than biological resource preservation mechanisms.

This document addresses the management recommendations and requirements for conserved and unconserved vernal pool sites in both public and private ownership in the City of San Diego. Legally binding requirements include those set forth in approved mitigation and/or restoration plans, habitat conservation plans issued under ESA Section 10, Biological Opinions (BOs) resulting from ESA Section 7 consultations, and other conservation agreements. Current management recommendations and activities at otherwise conserved or unconserved areas are voluntary and may be performed at the discretion of the land owner and/or manager. For unconserved sites, these recommendations should be implemented as part of any future site development proposal(s) as project conditions and mitigation requirements.

### **Dedication in fee title**

The mechanisms for biological resource conservation are defined in the San Diego, Land Development Code Biology Guidelines (City of San Diego, 2001). Dedication in fee title involves the transference of real property from the owner to the

City. Under direction of the City, parcel(s) or portions thereof may also be dedicated to other conservation entities, such as USFWS or the Nature Conservancy.

#### Conservation Easement

Conservation easements may be established to limit or relinquish development rights to specific parcels or portions thereof. These easements contain standard language to prohibit clearing, grubbing, grading, or other disturbances of native vegetation. The agreement is in favor of the City of San Diego, with USFWS and CDFG named as third party beneficiaries.

#### Covenant of Easement

A covenant of easement defines future land use through a legally binding agreement between the property owner and the City. In addition to prohibiting development and other disturbances, the covenant identifies permissible passive activities and other applicable permit conditions. As in a conservation easement, USFWS and CDFG are named as third party beneficiaries. The covenant is recorded against the title of the property and runs with the parcel(s) or portions thereof.

#### **Enhancement and Restoration**

In addition to property conservation, mitigation and/or other permit requirements often include enhancement, restoration, or creation of vernal pool habitat. Approximately 500 vernal pools included in the Vernal Pool Inventory (City of San Diego, 2004) were modified to some degree. Although often included in permit conditions, fencing and trash removal are not considered modifications of the vernal pool environment.

#### Enhancement

Enhancement is the modification of existing, functional vernal pools through weed removal, restoration of upland habitat, and pollution control measures.

#### Restoration

Restoration is the reestablishment of the ecosystem processes in basins that are physically present but have ceased to function as vernal pools. This is often accomplished through removal of impacts (e.g. ORVs, cattle) and invasive species, and reintroduction of vernal pool obligatory species. Restoration may also include more intensive efforts such as the establishment of new vernal pool basins in areas where historic vernal pools have been completely destroyed. This includes grading to create vernal pool basins as well as species introduction and restoration of watershed/upland areas.

Intensive vernal pool restoration efforts have received mixed responses from the involved parties. Initial concern led the USFWS revise the SANDER site mitigation requirements to substitute the Vernal Pool Management Plan (City of San Diego, 1996) for restoration of 0.04 acres of vernal pool basins. In recent years, however, projects within the City have intensively restored nearly 400 vernal pool basins to mitigate development impacts with wildlife agencies. The success of restoration efforts is determined according to goals reflecting species composition at historic and nearby vernal pool complexes. Although vernal pool restoration is considered an acceptable

form of mitigation, this plan recommends extensive comparison studies between natural and restored vernal pool complexes in San Diego to determine differences, if any, and to refine and improve future restoration projects.

## **6.0 GENERAL RECOMMENDATIONS**

### **6.1 *Recommendations from Previous Studies***

General management recommendations for San Diego vernal pools have been presented by Dr. Ellen Bauder (1986), the City of San Diego (1996) and the USFWS (1998). The purpose of this management plan is to determine the degree to which these directives have been implemented, evaluate their success, and update the recommendations to address current conditions in the City of San Diego.

*San Diego vernal pools: Recent and projected losses; their condition; and threats to their existence, 1979-1990*

Dr. Ellen Bauder, 1986

- Preservation of remaining vernal pool habitat, with emphasis on preserve design to minimize habitat fragmentation
- Preferential acceptance of natural vernal pools over created vernal pools for mitigation
- Major amendments to or replacement of the City of San Diego Vernal Pool Preservation Program (1980)
- Creation of regional, interagency vernal pool management plan
- Secure vernal pool sites from ORV damage
- Vernal pool training sessions for in-the-field utility, maintenance, and emergency response crews
- Development of volunteer corps for trash and weed removal

*Vernal Pool Management Plan*

City of San Diego, 1996

- Survey and assessment of resources
- Assessment of physical conditions
- Clean-up of vernal pool sites
- Protection of vernal pool sites
- Restoration of vernal pool sites
- Training for City personnel involved in siting, environmental assessment, and construction of capital improvement projects and public project permitting

*Recovery Plan for Vernal Pools of Southern California*

U.S. Fish and Wildlife Service, 1998

- Design and establish a vernal pool habitat preserve system within each management area
- Reestablish vernal pool habitat to historic structure and composition to increase genetic diversity and population stability
- Rehabilitate secured vernal pool habitats and their constituent species
- Manage protected habitat and monitor protected habitat and listed species

Acquisition of extensive vernal pool sites has become an important preservation goal, in part due to the approval of the MSCP. Land acquisition is accomplished through purchase from private ownership, conservation easements, and mitigation requirements. Over 50% of the vernal pools in the City of San Diego are considered conserved (i.e., under long-term protection from development), across over 21.11 acres.

The VPPP was replaced by the City of San Diego Vernal Pool Management Plan (VPMP) in 1996. The 1996 document was designed to improve understanding and management of vernal pools among City departments, especially in-the-field utility, maintenance, and emergency response crews. When completed, this City-wide Vernal Pool Management Plan will replace the existing VPMP.

Although individual jurisdictions have prepared vernal pool management plans (e.g., MCAS Miramar, City of San Diego), there are no plans for a regional management document.

The recommended survey and assessment of resources was completed in 2003 as part of the Vernal Pool Inventory (City of San Diego, 2004). This project also assessed the physical and biological condition of the pools, further fulfilling the management directives of the 1996 document. Vernal pool protection, clean-up, and restoration were other important recommendations included in the VPMP. Over half of the vernal pools in San Diego have been protected from development through federal and local regulations. Vernal pool enhancement and restoration are now standard mitigation requirements for project permit issuance.

## **6.2 Current Recommendations**

As documented in previous vernal pool survey and research efforts (e.g., Bauder, 1996 and City of San Diego, 2004), many basins in San Diego have been degraded and may be functioning at a suboptimal level. These sites should be conserved, enhanced and/or restored as needed. This may be accomplished through government implementation, project mitigation requirements, and/or interested NGOs. The standardization of such restoration efforts is expected to decrease the time and costs associated with project development and approval while improving the degree of success.

Vernal pool research is necessary for effective preservation. Uninformed conservation strategies may lead to long-term damage and loss of biodiversity. Research on location and function of vernal pools has opened doors for further study, such as the fairy shrimp genetic studies completed as part of this project. The City encourages academic institutions and agencies to study vernal pool plant genetics, native pollinators, and dispersal mechanisms. Comparisons of natural and restored basins are also recommended.

Public education is a vital part of any conservation program. Increased public awareness of vernal pools and the fascinating species they support will decrease inadvertent impacts to basins and provide a political basis for future conservation. Informational signs and kiosks at publicly accessible vernal pools sites, as well as educational programs for adults and children, should be implemented where possible. Educational signs are currently in place at some vernal pool sites and planned at several others. Public awareness programs may be appropriate at venues such as Earth Day fairs, the San Diego Natural History Museum, environmental organization meetings, and elementary school environmental education segments.

### **6.3** *Planned Actions and Responsibilities*

The recommendations included in this Vernal Pool Management Plan are prioritized below.

Priority 1: Conservation of land comprising the vernal pool site(s) through government or private land trust acquisition, dedication in fee title, conservation easement, or covenant of easement. Conservation should include long-range management where needed.

Priority 2: Adequately protect conserved vernal pool(s) from illegal and/or inadvertent impacts by means such as fencing, signage, education and/or law enforcement patrol.

Priority 3: Enhance or restore (including intensive restoration) vernal pools to reinstate historic ecosystem functions and values of vernal pools in San Diego. Restoration projects should be based on current, peer-reviewed research to ensure long-term viability.

Priority 4: Solicit and fund, if possible, research on vernal pool ecosystems on topics including, although not limited to, watersheds, hydrology, plant and invertebrate genetics, pollinator/plant interactions, and comparisons of restored and natural vernal pools.

Recommendations are enforceable under the following conditions: 1) Permit conditions; 2) approved Mitigation, Monitoring and Reporting Programs; 3) a Biological Opinion (BO) resulting from a Section 7 consultation with the USFWS; 4) development agreement(s) and/or mitigation deemed satisfactory by the USFWS, CDFG, and the Mayor of San Diego or designee. Responsibility falls to the party named as such in the conditions, BO, or mitigation plan.

### **6.4** *Use of this Document*

As discussed previously, the purpose of this document is to provide a comprehensive management strategy for vernal pool sites throughout the City of San Diego. Multiple documents and records, historic and current, are kept by various agencies, which hampers the ability of land managers to synthesize and utilize existing information. This document attempts to review and consolidate the available data, and to provide both general and site-specific management recommendations in a format both readily available and usable.

We strongly recommend use of this document in conjunction with the Vernal Pool Inventory (City of San Diego, 2004), which contains site-specific biological information. All plant data referenced in the site-specific management recommendations sections are from the Vernal Pool Inventory database, while fairy shrimp data include both Inventory and USFWS GIS database information.

For ease of use, a summary table has been included for information such as site area, presence of sensitive species, etc. However, this should not take the place of the site-specific sections, which contain general site information, threats, previous restoration history (if any), and the analysis used to develop the recommendations. Natural systems and their surroundings are dynamic, and it should be recognized that the most productive and/or important management needs of a site will change over time. This document

should serve as a guide, but should be used in conjunction with careful consideration of the current environment, including natural setting, recent research and the most up-to-date restoration and monitoring techniques.

Other documents, of both research and regulatory nature, exist for many of the vernal pool sites in San Diego. This Vernal Pool Management Plan does not supersede existing, adopted management plans for 1) open space areas with vernal pools (e.g. Carmel Mountain) or 2) mitigation sites (e.g. Salk Institute); but rather should be used in conjunction with existing documents.

In summary, this document addresses the management recommendations and requirements for conserved and unconserved vernal pool sites in both public and private ownership in the City of San Diego. Legally binding requirements include those set forth in approved mitigation and/or restoration plans, USFWS Biological Opinions (BOs) resulting from ESA Section 7 consultations, and other conservation agreements. Where management plans exist, the requirements of those documents were incorporated into this Plan, and the original document was referenced. This Plan may also include recommendations which are above and beyond those of other plans, which should be pursued by the land-owner and/or governmental agencies as staffing and/or funding becomes available. However, current management recommendations and activities at otherwise conserved or unconserved areas are voluntary and may be performed at the discretion of the land owner and/or manager. In cases where the site is unconserved and may develop in the future, the site-specific management recommendations included in this Plan should be used as a guide in developing the management plan (see Appendix A) and/or restoration plan (see Appendix B) and implemented as mitigation measures. In cases where the site is conserved but a management plan does not currently exist and/or there are no required mitigation activities, this document will serve as the management plan.

## 7.0 Cross Reference for Vernal Pool Sites

Some of the vernal pool sites have been renamed due to project changes, ownership, land acquisition, the Vernal Pool Inventory, etc. A partial list of old-to-new names follows (from north to south):

| Historic Name                  | Name in VPMP             | Bauder ID    |
|--------------------------------|--------------------------|--------------|
| Great Western                  | Del Mar Mesa             | H 1-15       |
| Fletcher                       | Del Mar Mesa             | H 1-15       |
| Miller                         | Del Mar Mesa             | H 1-15       |
| Copp                           | Del Mar Mesa             | H 1-15       |
| Gleich                         | Del Mar Mesa             | H 1-15       |
| CalTrans Vernal Pool Preserve  | Del Mar Mesa             | H 1-15       |
| Penasquitos Substation         | H 33                     | H 31-32, 38* |
| Penasquitos Park View Estates  | Tierra Alta              | B 5-6*       |
| Pipefitters                    | Lopez Ridge              | B 5-6        |
| Brown Parcel                   | Lopez Ridge              | B-5-6        |
| New Century Center             | General Dynamics         | N 8*         |
| Spectrum Center                | General Dynamics         | N 8*         |
| Maddox                         | Jonas Salk Elementary    | C 28*        |
| Mason Hague                    | Jonas Salk Elementary    | C 28*        |
| Lyons                          | Fieldstone               | C 17-18      |
| Bob Baker                      | Ford Leasing             | I 6 B        |
| Bob Baker 2                    | Facilities Development   | I 6 C        |
| Dennery Canyon                 | Cal Terraces/Recon South | J 2 N/W/S*   |
| Handler                        | J 14                     | J 14         |
| Anderson                       | J 14                     | J 14         |
| Borewitz                       | J 14                     | J 14         |
| Otay Border Crossing           | J 14                     | J 14         |
| Biddle                         | J 16-18                  | J 16-18      |
| Jennings                       | J 16-18                  | J 16-18      |
| Otay 19 Associates             | J 16-18                  | J 16-18      |
| RR Sesi                        | J 4                      | J 4*         |
| Bachmann                       | J 34                     | J 34*        |
| Rancho Villa                   | J 34                     | J 34*        |
| Santee Investments             | J 34                     | J 34*        |
| Clayton                        | J 2 W                    | J 2 W        |
| St. Jerome                     | J 2 W                    | J 2 W        |
| Sweetwater High School Old J 3 | J 3                      | J 3          |
| Empire Center                  | J 27                     | J 27         |
| Otay Ranch                     | J 29-30                  | J 29-30      |
| Baldwin                        | J 29-30                  | J 29-30      |
| Lonestar                       | J 29-30                  | J 29-30      |
| La Media Pools                 | J 28 E                   | J 28 E       |

\*Not mapped by Bauder, see Table 1 of Vernal Pool Inventory (City of San Diego, 2004)

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**Table 1 - Vernal Pool Management Plan Site Information**

| Area                   | Revised Bauder ID | Site                                | Number of Basins | Site Acreage | Basin Acreage | Conserved | Soil                         | Ownership                             | Managed | Management Party  | Fencing  | Signage  | Weeding/ Invasive Removal | Funding |
|------------------------|-------------------|-------------------------------------|------------------|--------------|---------------|-----------|------------------------------|---------------------------------------|---------|---|----------|----------|---------------------------|---------|
| <b>Del Mar Mesa</b>    |                   |                                     |                  |              |               |           |                              |                                       |         |   |          |          |                           |         |
|                        | H 1-15            | Del Mar Mesa                        | 344              | 779          | 5.5           | Yes       | Redding Gravelly Loam        | City of SD, County of SD, CDFG, USFWS | Yes     | City of SD MWWWD, Mira Mesa Market Center, City of SD - ESD, CA Dept. of Transportation | Yes, D   | Yes, D   | Yes, D                    | **      |
|                        | H 17              | Shaw Texas                          | 26               | 200          | 0.23          | No        | Redding gravelly loam,       | Private                               | Yes     | Pardee Construction Company, HOA  | Yes, C   | Yes, C   | Yes, C                    | Yes, D  |
|                        | H 18-23           | Rhodes                              | 152              | 102          | 0.75          | No        | Redding gravelly loam        | Private                               | Yes     | Project applicant   | Yes, C   | Yes, C   | Yes, C                    | **      |
|                        | H 39              | Greystone Torrey Highlands          | 19               | 3.5          | 0.68          | Yes       | Olivenhain cobbly loam       | City of SD                            | Yes     | City of SD Park and Recreation  | Yes, C/D | Yes, C/D | Yes, C/D                  | **      |
|                        | H 40              | Li Collins                          | 2                | 0.3          | 0.38          | Yes       | Olivenhain cobbly loam       | Private                               | Yes     | Private   | Yes, C   | Yes, C   | **                        | **      |
| <b>Carmel Mountain</b> |                   |                                     |                  |              |               |           |                              |                                       |         |   |          |          |                           |         |
|                        | H 31-32, H 38     | Carmel Mountain                     | 30               | 300          | 0.32          | Yes       | Carlsbad gravelly loamy sand | City of SD                            | Yes     | City of SD Park and Recreation  | Yes, B   | Yes, B   | Yes, B                    | **      |
| <b>Mira Mesa</b>       |                   |                                     |                  |              |               |           |                              |                                       |         |   |          |          |                           |         |
|                        | B 5-6             | Tierra Alta                         | 1                | 0.1          | 0.0055        | Yes       | Redding gravelly loam        | Private                               | Yes     | City of SD ESD  | Yes, C   | **       | **                        | **      |
|                        | B 5-8             | Lopez Ridge                         | 13               | 12.4         | 0.48          | Yes       | Redding gravelly loam        | City of SD                            | No      | **  | Yes, D   | Yes, D   | **                        | Yes, D  |
|                        | B 5-8             | Crescent Heights                    | 7                | 36           | 0.042         | No        | Redding gravelly loam        | Private                               | No      | **  | Yes, B   | **       | **                        | **      |
|                        | B 11              | Mesa Norte                          | 45               | 5            | 0.58          | Yes       | Redding gravelly loam        | Private                               | Yes     | Helix Environmental   | Yes, D   | Yes, D   | Yes, D                    | YesD    |
|                        | C 10-16           | Winterwood                          | 61               | 20           | 0.81          | Partial   | Redding gravelly loam        | City of SD                            | Yes     | City of SD Park and Recreation  | Yes, E   | Yes, D   | **                        | **      |
|                        | C 17-18           | Fieldstone                          | 9                | 4.3          | 0.32          | Yes       | Redding gravelly loam        | Private                               | No      | **  | Yes, D   | **       | **                        | **      |
|                        | C 27              | Mira Mesa MarketCenter              | 1                | 0.29         | 0.057         | Yes       | Redding gravelly loam        | Private                               | No      | **  | Yes, C   | Yes, C   | **                        | **      |
|                        | C 28              | Jonas Salk Elementary               | 82               | 13           | 0.97          | No        | Redding gravelly loam        | San Diego Unified School District     | No      | **  | **       | **       | **                        | **      |
|                        | D 5-8             | Parkdale Carroll Canyon             | 4                | 19           | 0.021         | No        | Redding gravelly loam        | City of SD                            | No      | **  | Yes, B   | **       | **                        | **      |
|                        | D 5-8             | Carroll Canyon                      | 119              | 19           | 1.19          | Yes       | Redding gravelly loam        | City of SD                            | Yes     | City of SD Park and Recreation  | Yes, D   | Yes, D   | **                        | **      |
|                        | I 1               | Arjons                              | 34               | 8.7          | 0.73          | Yes       | Redding gravelly loam        | Private                               | Yes     | Private   | Yes, D   | **       | **                        | **      |
| <b>Nobel Drive</b>     |                   |                                     |                  |              |               |           |                              |                                       |         |   |          |          |                           |         |
|                        | I 6 B             | Ford Leasing /Bob Baker             | 8                | 0.5          | 0.077         | No        | Redding gravelly loam        | Private                               | No      | **  | **       | **       | **                        | **      |
|                        | I 6 C             | Facilities Development /Bob Baker 2 | 15               | 2            | 0.24          | No        | Redding gravelly loam        | Private                               | No      | **  | Yes, D   | **       | **                        | Yes, D  |
|                        | I 12              | Pueblo Lands                        | 3                | 10.3         | 0.017         | No        | Redding gravelly loam        | City of SD                            | Yes     | City of SD MWWWD  | **       | **       | **                        | **      |
|                        | X 5               | Nobel Drive                         | 7                | 94           | 0.085         | Yes       | Redding gravelly loam        | City of SD                            | Yes     | City of SD Park and Recreation  | Yes, B   | **       | **                        | Yes     |
|                        | X 7               | Nobel Research Park                 | 28               | 3.49         | 0.098         | Yes       | Redding gravelly loam        | Private                               | No      | **  | Yes, E   | **       | **                        | **      |

\*\* - Not provided  
 B - Provided, no requirement  
 C - Provided, Per City Permit  
 D - Provided, Per BO  
 E - Provided, Per mitigation requirements  
 F - Project processing; to be provided upon project approval

|                                     |              |                                     |     |       |       |         |  |                                   |           |  |                |        |    |    |
|-------------------------------------|--------------|-------------------------------------|-----|-------|-------|---------|--|-----------------------------------|-----------|--|----------------|--------|----|----|
| <b>Kearny Mesa</b>                  |              |                                     |     |       |       |         |  |                                   |           |  |                |        |    |    |
|                                     | N 1-6        | Montgomery Field                    | 276 | 544   | 6.76  | No      | Redding gravelly loam  | City of SD                        | Yes       | City of SD Airport Division                      | Yes, D         | **     | ** | ** |
|                                     | N 7          | Serra Mesa Library                  | 25  | 9.2   | 0.36  | Yes     | Redding gravelly loam  | City of SD                        | Yes       | City of SD Park and Recreation and Library Depts | Yes            | **     | ** | ** |
|                                     | N 8          | General Dynamics                    | 21  | 4.74  | 0.4   | Yes     | Redding gravelly loam  | Private                           | Yes       | Private  | Yes, E         | **     | ** | ** |
|                                     | U 15         | Magnatron                           | 1   | 1     | 0.34  | No      | Redding gravelly loam  | City of SD                        | Partially | City of SD Real Estate Assets                    | **             | **     | ** | ** |
|                                     | U 15         | Sander                              | 33  | 30.6  | 0.44  | No      | Redding gravelly loam  | City of SD                        | Yes       | City of SD Environmental Services                | Yes, Partially | **     | ** | ** |
|                                     | U 19         | Cubic                               | 29  | 13.5  | 0.45  | No      | Redding gravelly loam  | Cubic Corp                        | No        | **   | **             | **     | ** | ** |
|                                     | N 1-4, N 5-6 | Teledyne Ryan                       | **  | 11.25 | 0.59  | No      | Redding gravelly loam  | Private                           | No        | **   | **             | **     | ** | ** |
| <b>Mission Trails Regional Park</b> |              |                                     |     |       |       |         |  |                                   |           |  |                |        |    |    |
|                                     | Q 2          | Mission Trails Regional Park        | 15  | 5760  | 0.24  | Yes     | Redding gravelly loam  | City of SD                        | Yes       | City of SD Park and Recreation                   | Yes            | **     | ** | ** |
|                                     | Q 2          | Mission Trails School District Site | 2   | 11.73 | **    | No      | Olivenhain cobbly loam   | San Diego Unified School District | No        | **   | Yes, B         | **     | ** | ** |
|                                     | Q 3          | Castle Rock                         | 11  | 1.92  | **    | Partial | Diablo Olivenhain soil complex                                 | Private                           | **        | **   | **             | **     | ** | ** |
|                                     | Q 3          | Pasatiempo                          | 10  | 10.7  | **    | No      | Bosanko clay, Diablo-Urban land complex, Redding gravelly loam | City of SD                        | Yes       | City of SD Real Estate Assets                    | **             | **     | ** | ** |
|                                     | Q 4          | Lake Murray                         | 1   | **    | **    | Yes     | Tujunga sand   | City of San Diego                 | Yes       | City of San Diego Park and Recreation            | **             | **     | ** | ** |
| <b>Urban San Diego</b>              |              |                                     |     |       |       |         |  |                                   |           |  |                |        |    |    |
|                                     | S 4          | Kelton                              | 3   | 29    | 0.022 | Yes     | Hueruero loam  | City of SD                        | Yes       | City of SD Park and Recreation                   | **             | **     | ** | ** |
|                                     | **           | Tecolote Canyon                     | 9   | 950   |       | Yes     | Chestern-Urban land complex, Hueruero loam                     | City of SD                        | Yes       | City of SD Park and Recreation                   | **             | **     | ** | ** |
| <b>Otay Lakes</b>                   |              |                                     |     |       |       |         |  |                                   |           |  |                |        |    |    |
|                                     | K 3,5,10,13  | Otay Lakes                          | 87  | 632   | 2.89  | No      | Olivenhain, San Miguel and Redding Series                      | City of SD                        | Yes       | City of SD Water                                 |                |        |    |    |
|                                     | R 1          | Proctor Valley                      | 19  | 157   | 0.25  | No      | Olivenhain cobbly loam   | City of SD                        | Yes       | City of SD Water                                 | Yes, D         | Yes, D | ** | ** |
|                                     | K Series     | Otay Filtration Plant               | 1   | 1     | 0.27  | Yes     | Olivenhain cobbly loam   | City of SD                        | Yes       | City of SD Water                                 | Yes            | Yes    | ** | ** |

\*\* - Not provided  
 B - Provided, no requirement  
 C - Provided, Per City Permit  
 D - Provided, Per BO  
 E - Provided, Per mitigation requirements  
 F - Project processing; to be provided upon project approval

| Otay Mesa     |                        |     |        |       |         |   |                                       |           |  |        |        |        |     |
|---------------|------------------------|-----|--------|-------|---------|---|---------------------------------------|-----------|--|--------|--------|--------|-----|
| J 2 S         | Otay Mesa Road Helix   | 13  | 1      | 0.21  | Yes     | Stockpen gravelly clay loam                                     | City of SD                            | Yes       | City of SD Park and Recreation                       | Yes, D | Yes, D | **     | **  |
| J 2 W         | Otay Mesa Road Recon   | 20  | 2.5    | 0.45  | Yes     | Stockpen gravelly loam  | City of SD                            | Yes       | City of SD Real Estate Assests                       | Yes, D | Yes, D | **     | Yes |
| J 2 W         | J 2 W                  | 59  | 40     | 0.68  | No      | Stockpen gravelly loam, Olivenhain cobbly Loam                  | Private                               | No        | Private  | **     | **     | **     | **  |
| J 2 W, J 31   | Hidden Trails          | 42  | 76.52  | 0.13  | Yes     | Olivenhain cobbly loam, Stockpen gravelly clay loam             | Private                               | No        | Private  | **     | **     | **     | **  |
| J 3           | J 3                    | 5   | 42     | 0.087 | No      | Stockpen gravelly loam  | Private                               | No        | Private  | **     | **     | **     | **  |
| J 4           | J 4                    | 11  | 15     | 0.094 | Yes     | Stockpen gravelly loam  | Private                               | No        | Private  | **     | **     | **     | **  |
| J 4-5         | Robinhood Ridge        | 83  | 16     | 0.56  | No      | Olivenhain cobbly loam,Diablo clay, Stockpen gravelly loam      | City of SD                            | Yes       | City of SD Park and Recreation                       | Yes, E | Yes, E | **     | **  |
| J 11 E        | J 11 E                 | 2   | 40.53  | 0.63  | No      | Olivenhain cobbly loam  | Private                               | No        | Private  | **     | **     | **     | **  |
| J 11 W        | J 11 W                 | 5   | 40.53  | 0.49  | No      | Olivenhain cobbly loam  | Private                               | No        | Private  | **     | **     | **     | **  |
| J 12          | J 12                   | 5   | 163.56 | 0.28  | No      | Olivenhain cobbly loam  | Private                               | No        | Private  | **     | **     | **     | **  |
| J 13 E        | J 13 E                 | 8   | 163.56 | 0.059 | No      | Olivenhain cobbly loam, Hueruero loam                           | Private                               | No        | Private  | **     | **     | **     | **  |
| J 13 N        | J 13 N                 | 41  | 40     | 0.28  | No      | Olivenhain cobbly loam, Hueruero loam                           | Private                               | No        | Private  | **     | **     | **     | **  |
| J 13 S        | J 13 S                 | 44  | 108    | 0.62  | No      | Hueruero loam   | Private                               | No        | Private  | **     | **     | **     | **  |
| J 14          | J 14                   | 58  | 105    | 0.6   | No      | Stockpen gravelly clay loam, Olivenhain cobbly loam             | Private, City of SD                   | Partially | City of SD Park and Recreation                       | **     | **     | **     | **  |
| J 14          | 905                    | 7   | 38     | 0.069 | Partial | Stockpen gravelly clay loam                                     | City of SD                            | Yes       | City of SD, Real Estate Assests, Park and Recreation | **     | **     | **     | **  |
| J 14          | Recon South            | 64  | 17.7   | 1.4   | Yes     | Gravel pits, Stockpen gravelly clay loam,Olivenhain cobbly loam | City of SD                            | Yes       | City of SD Park and Recreation                       | **     | **     | **     | **  |
| J 15          | Amie's Point           | 29  | 150    | 0.65  | Yes     | Stockpen gravelly clay loam                                     | United States of America              | **        | **   | Yes, D | Yes, D | **     | **  |
| J 16-18       | J 16-18                | 13  | 99     | 0.4   | Yes     | Stockpen gravelly clay loam                                     | City of SD                            | Yes       | City of SD Park and Recreation                       | **     | **     | **     | **  |
| J 16-18       | Wruck Canyon           | 6   | 9.3    | 0.016 | Yes     | Stockpen gravelly clay loam                                     | City of SD                            | Yes       | City of SD   | **     | **     | **     | **  |
| J 21          | J 21                   | 7   | 49     | 0.21  | No      | Hueruero loam   | Private                               | No        | Private  | **     | **     | **     | **  |
| J 27          | J 27                   | 10  | 6.4    | 0.23  | No      | Hueruero loam   | Private                               | No        | Private  | **     | **     | **     | **  |
| J 28 E        | J 28 E                 | 5   | 20     | 0.16  | No      | Stockpen gravelly clay loam                                     | Private                               | No        | Private  | **     | **     | **     | **  |
| J 29-30       | J 29-30                | 76  | 664    | 0.98  | No      | Stockpen gravelly clay loam                                     | Private                               | No        | Private  | **     | **     | **     | **  |
| J 32          | West Otay A + B        | 44  | 9      | 0.34  | Yes     | Stockpen gravelly clay loam                                     | Private                               | No        | Private  | **     | **     | **     | **  |
| J 33          | Sweetwater High School | 8   | 50     | 0.065 | Yes     | Olivenhain cobbly loam  | Sweetwater Union High School District | Yes       | Sweetwater Union High School District                | Yes, E | Yes, E | **     | **  |
| J 34          | J 34                   | 14  | 246    | 0.15  | No      | Hueruero loam, Olivenhain cobbly loam                           | Private                               | No        | Private  | **     | **     | **     | **  |
| J 35          | Brown Field            | 2   | 74     | 0.01  | No      | Stockpen gravelly loam  | City of SD                            | Yes       | City of SD Airport Division                          | **     | **     | **     | **  |
| J 2 N/W/S     | Cal Terraces           | 335 | 172.7  |       | Yes     | Stockpen gravelly loam  | City of SD                            | Yes       | City of SD   | Yes, D | Yes, D | Yes, D | **  |
| Marron Valley |                        |     |        |       |         |   |                                       |           |  |        |        |        |     |
| MM 1          | Marron Valley          | 14  | 2644   | 0.18  | Yes     | Hueruero loam,Visalia gravelly sandy loam, Stony land           | City of SD                            | Yes       | City of SD Water                                     | Yes, B | Yes, B | Yes,B  | Yes |

\*\* - Not provided  
 B - Provided, no requirement  
 C - Provided, Per City Permit  
 D - Provided, Per BO  
 E - Provided, Per mitigation requirements  
 F - Project processing; to be provided upon project approval

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